Bruhat Bengaluru
Mahanagara Palike

BRUHAT BANGALORE MAHANAGAR PALIKE
EXCECUTIVE ENGINEER YELAHANKA ZONE PROJECT DIVISION

DETAILED PROJECT REPORT

TOTAL ESTIMATED COST-200 Lakhs

NAME OF THE WORK:

CONSULTANCY SERVICES FOR PREPARATION OF DPR FOR THE WORK OF ASPHALTING TO ROADS AT CHOWDAPPA LAYOUT , MARUTHI LAYOUT, HILLSIDE MEDOWS AND SURROUNDING AREAS IN WARD NO - 03 YELAHANKA SATELLITE TOWN SUB DIVISION

TRANSHEIGHT CONSULTANTS PVT.LTD
205,10th Cross, 'G' Block
Sahakaranagar, Bangalore-560092
E-mail :transheight.consultant@gmail.com
Ph.No : 080 23629195
URL: www.transheightconsultants.com

Contents

Chapter-1	**Introduction**	**Pages 2 to 7**
Chapter-2	**Engineering Survey**	**Pages 8 to 10**
Chapter-3	**Design Proposals**	**Pages 11 to 20**
Chapter-4	**Analysis, Design and Improvements**	**Pages 21 to 22**
Chapter-5	**Cost Estimates**	**Pages 23to 41**
Chapter-6	**Conclusion**	**Pages 42**

Annexure-1 Estimation

Annexure-2 Photographs

Chapter 1

Introduction

1.1 Background

The well connected road network helps to boost the economy and prosperity of the area. The good road provides lots of benefits to road users, such as connectivity, easily availability of goods and materials with in stipulated time. Bangalore is third largest populated city in India with a total population of 11.50 million. It is also called as garden city. There are many gardens and parks. Bangalore is the capital of Karnataka state which has under gone revolutionary changes in various fields and witnessed steep growth in Auto-mobile Industry. It is a growing metropolitan city faces many challenges especially in pollution and logistical areas. The city is situated at an altitude of 900mts with co-ordinates of 12^{o} 97' N (Latitude) and 77^{o} 56' E (Longitude). The temperature varies from 23^{o}C and 36^{o}C. The average Rainfall of the area is about 850mm per year. The city is well connected with remaining part of the country through Road, Rail network and Air.

Bruhat Bengaluru Mahanagara Palike has decided to improve the existing road network system, drains, bus bays and footpath facilities for pedestrians in order to cope up with the growing demand of two wheelers, light commercial and heavy vehicles.

1.2 Objective

The object of the present work is to prepare detailed project report covering various studies viz., Topography survey, Subsoil investigations, Traffic surveys, and Hydraulics and Total station surveys. The proposed improvements consists Design of Geometrics, side drains, Widening/Strengthening/Reconstruction of carriageway along with Footpath and road safety measures. The scope of work also includes the quantifying of various items of works and cost estimate.

1.3 Project Location

Consultancy Services for preparation of Survey, Designs, Drawing, Estimate preparation etc., (Detailed Project Report) for the work of Construction of Asphalt roads at chowdappa layout , Maruthi Layout, Hillside Medows and surrounding areas in ward no -03 Yelahanka Satellite Town sub Division.

1.3.1 Key map

Cross 5th-108m
Cross 4th-135m
Cross 4th-82m
Cross 3rd-175m
Cross 3rd-77m
Cross 2nd-52m
Cross 2nd-66m
1st Main Road -240m
Chowdappa Layout1st Main Road -200m
BHEL 5th cross Road Drain-110m
BHEL 4th cross Road Drain-115m
BHEL 3rd cross Road Drain-118m
BHEL 2nd cross Road Drain-125m
BHEL 1st cross Road Drain-125m
Pal Exports/Exim factory - Bangalor
Presidency Boys Hoste
Santhosh Lingappe
Parampara Public School
Temporarily closed
Moonglow B&B
12th Cross Rd
6th Cross Rd
2nd Cross Rd
Rishi P.V.T
Chowdappa Layout Resident's...
M a store
Jalathara Park

1.4 Client

The client is Bruhat Bengaluru Mahanagara Palike, Bengaluru and is the Authority for the implementation of the project.

1.5 Consultant

Transheight Consultants Pvt Ltd Bangalore has been entrusted with the work of preparation of detailed project report including the cost estimate for the road network in ward no 03.

1.6 Document Organization

Based on the approach and methodology and from the available data, including the results of survey and investigation carried out, this report has been compiled and organized as follows.

Chapter 1 - Introduction
Chapter 2 - Engineering Survey
Chapter 3 - Design Proposals
Chapter 4 - Analysis, Design and Improvements
Chapter 5 - Cost Estimates

Annexure-1 Design details of RCC Drain and Culverts
Annexure-2 Drawings
Annexure-3 Photographs

1.7 Scope and Deliverable

1. Construction of Asphalt roads at chowdappa layout , Maruthi Layout, Hillside Medows and surrounding areas in ward no -03, Scope of work can be broadly classified as follows: -

- Inventory of existing Road, Drains and Culverts
  ---Condition survey of Road, Drains and Culverts
  ---Condition survey of existing Road, Drains and Culverts
- Analysis, Design and Improvements
- BOQ and cost estimates
- Drawings
- Photographs

Chapter 2

Engineering Survey

2.1 General

The Detailed Topographic Survey forms the backbone for any road Improvement project. The basic objective of the topographic survey is to collect necessary available ground features along existing road alignment/new alignment in order to consider the type of improvements, rehabilitation and to design the new pavement. The detailed topography survey has been taken up after the completion of reconnaissance surveys. The data collected has been adopted in Analysis, Design and Cost estimate.

2.2 Road Inventory

The detailed road inventory survey has carried out for the project roads under consideration. The data is compiled in tabular form, developed using Excel computer software. The data collected include:

- Type of terrain
- Land use
- Name of Area
- Existing Bus Stop Details
- ROW details
- Carriageway width
- Type of surfacing
- Width and type of Shoulders
- Road Intersections (s) and their details
- Height of embankment
- Formation width
- Land width(ROW)
- Culverts, bridges and other structures (type, size, span, arrangement, and location)
- Utility services on either side of the road and within the ROW.
- General drainage conditions

2.3 Cross drainage structures inventory

Inventory and condition survey of the existing cross drainage were carried out to identify their number, type, condition & hydrological aspects. Only visual in spection & dimensional measurements have been carried out during this survey. This enables to collect the visible "As Built" information to the extent possible & their condition to assess individual requirements of the existing structure.

The visual observations were carried out during the condition survey to find out any distress / deficiencies. In addition to the superstructure, masonry, PCC and RCC sub-structure were also examined for any crack; loose joints etc. wherever accessible for RCC culverts. Following details pertaining to the CD Inventory is collected.

- Chainages of structure
- Type of CD structure
- Span Arrangement
- Structure width
- Structure condition and Recommendations

2.4 Road Drainage inventory

The drain inventory survey has been conducted to know the features of the stretch, such as cover slab type and condition, drain type and condition, details of section, etc. From the data collected, it is observed that the stretch is having drain in good to poor condition. The data collected from the road and drain inventory survey.

2.5 Pavement Condition Survey

Condition Survey is undertaken by visual assessments for the Pavement and Cross Drainage, which would cover not only the type but also the magnitude of the distress and its location. Based on the condition evaluation, the causes for various defects observed are examined in detail and decision taken whether to initiate a particular maintenance activity, defer the same, or to go in for more detailed investigations to determine the rehabilitation needs precisely where distress on the pavement has reached the stage of the pot-hole etc., affecting smooth operation of traffic, which needs rectification immediately.

The objective of the road and pavement condition survey is to identify defects and section with similar characteristics. All defects are systematically referenced, recorded, quantified for the purpose of determining the mode of rehabilitation.

In heavily built up commercial and residential areas, few existing concrete roads are showing distress and also damaged due to the laying of utility lines, telecommunication lines and underground drainage system and chambers. These damaged concrete roads are to be removed and replaced with the fresh concrete carriage way in order to maintain the existing Approach to houses .As per required site location.

Chapter-3

Design Proposal

3.1 Pavement Design

3.1.1 Introduction

Roads in Bruhat Bengaluru Mahanagara Palike have developed over decades especially in CBD. The pavement construction is essentially macadam, commensurate with the technology prevailing at that time. Macadam construction involves manually placed stone base bound with stone fines using water spray water bound macadam (WBM), topped by a poured / sprayed bituminous seal. These are essentially rough roads by today's standards. In due course these roads were over laid with bituminous layers and also with concrete.

3.1.2 Design Standards-General

Sl. no.	Design parameters	Reference Code
1	Geometric Design Standards • Carriageway width • Shoulder • Footpath • Median • Camber • Super Elevation • Horizontal Alignment • Vertical Alignment	As per IRC:38-1988, IRC:86-1983 & IRC:SP:23-1993
2	Road Furniture • Road Delineators • Road markings • Road Signs	As per IRC:79-1981 As per IRC:35-1997 As per IRC:67-2001
3	Road Capacity	As per IRC:106-1990
4	Flexible Pavements Design	As per IRC:37-2012
5	Road Drainage	As per IRC:SP: 42-1994 & IRC: SP:50-1999
6	Culverts	As per relevant IRC codes and MORT&H specifications
7	Bridges	

3.2 Design Standards related to Pavement design

3.2.1 Flexible Pavement Design:

Flexible Pavement is designed keeping in view the anticipated traffic on the project road and 2016 as base Year. The base year traffic is considered for projecting the same for a designperiodof15Years.Fromthevolumecount, commercial vehicles are considered for the pavement design. The design is based on Guidelines for the Design of Flexible pavements: IRC 37-2012.

$$N = 365 \times \frac{[(1+r)^n - 1] \times A \times D \times F}{r}$$

Where,

Ns = Cumulative number of standard axles to be catered in the design

A = Initial Traffic, in terms of commercial vehicles per day modified to account for lane distribution.

r = Annual growth rate of commercial vehicles is 7.50% (Adopted from the analysis). n = Design life in years (15 Years).

F = Vehicle Damage Factor, for the project road the pavement design has been carried out considering the following factors:

- Design the road in an embankment so as to have sub grade level above the water level due to capillary action at the adjoining fields.
- Good drainage layer for ensuring cross movement of water across the pavement.

3.2.2 Input

- **Base Year Traffic on the Project Road**

Initial Traffic in terms of commercial per day is considered for the pavement design. No. of commercial vehicles are derived based on the traffic volume count conducted on the project road sections.

The Traffic Survey data considered is presented in Table 3.1. The Sample Survey was conducted during February 2019 and summary of commercial vehicles per day for the project road is presented which is utilized for pavement design.

The traffic growth rate of 7.50 % is considered as per IRC: 37-2012 guidelines.

- **Design life**

For the design of pavement, the design life is defined in terms of the cumulative number of standard axles that can be carried before strengthening of the pavement is necessary.

The design life considered for the project road is 15 Years.

- **Vehicle Damage Factor**

The Vehicle Damage Factor (VDF) is a multiplier to convert the number of commercial vehicles of different axle loads and axle configuration to the number of standard axle load repetitions commercial vehicle.

The indicative value of vehicle damage factor as per IRC: 37-2012 are indicated in **Table-3.2.** Since the initial traffic volume for the project road is 185 commercial vehicles per day, the VDF value taken is 3.5 (paragraph 4.4.6). The majority of roads in extension area are single lane to intermediate lane.

Table 3.2 Indicative values of VDF

No	Initial traffic volume in terms of number of commercial vehicles per day	Terrain	
		Rolling/plain	Hilly
1	0-150	1.50	0.50
2	150-1500	3.50	1.50
3	More than 1500	4.50	2.50

- **Lane Distribution Factor**

Assessment of distribution of traffic by lane is necessary as it directly affects the total equivalent standard Axle load applications used in the design.

Lane Distribution factor for traffic considered for the project road is equal to total traffic in both directions.

- **Design CBR**

The result of laboratory tests carries out on the sub grade samples collected from the project stretch shows that the soaked CBR value for majority of the stretches is in between 6.00% to 7.00 %. The project road has been designed adopting average CBR value 6%. However at locations, if any, where CBR value less than 4% is noticed, it is proposed to have

a fill of selected sub grade of CBR value greater than 10% in pavement rehabilitation reaches.

3.2.3 Design of Crust

Based on the above mentioned parameters, flexible pavement crust is proposed as per IRC 37-2012 and furnished. (Refer page-5 of IRC 37-2012).

3.2.4 Shoulders

The paved shoulders have been designed with 3% cross slope to allow the surface drainage effectively to the side drains. The shoulders are to be paved with B.S. slabs of thickness 7.50 cms. It is also proposed to rectify the damaged kerb line.

3.2.5 Side Drains

The existing vent way of side drains have been checked for effective discharge of rainwater to the nearby Culverts.

3.2.6 Cross Drainage Structures

The adequacy of existing vents way size has been checked to accommodate the rainwatercollectedfromdifferentdirectionsanddischargethesametothenearbymain drains. It is also proposed to repair the different damaged components of existing Culverts and also to construct new Culverts where ever necessary.

3.2.7 Design Standards related to Geometrics Design

The improvements to horizontal and vertical curves are not required due to the low design speed, non-availability of existing land in heavily built up areas and topographyofthearea.Itisproposedtoimprovetheexistingroadsbywayofproviding additional crust composition over layers.

Design parameters	Specifications
1. Design Speed	40 Kmph
2. Geometric Design standards	
• Carriageway Width	Single lane to Intermediate lane
• Camber(Bi-direction)	2.5% for paved carriageway

• Super Elevation	Limited to 4%
• Footpath	Minimum width-1.5m
• Kerb	Barrier/semi-barrier/Mountable (Barrier type recommended)
• Min radius of Horizontal Curve	40m for a speed of 30kmph 105m for a speed of 50kmph
• Extra widening at Curves	Nil for radius above 300m
• Gradient	Max Gradient-4.0%(1 in 25) Min Gradient for Drainage-0.5% (Desirable minimum)& 0.3%(absolute minimum)

(Reference Code: IRC: 86-1983-"Geometric Design standard for Urban Roads in plains")

3.2.8 Road cross-sections

The project road shall be newly constructed / developed to have a single lane to inter mediate lane carriageway with paved/Earthen shoulder to suitable widthoneithersideisproposed.Thetypicalcrosssectionoftheroadshowingvarious existing and proposed components are enclosed along with estimates.

3.2.9 Road Furniture and Appetences

Traffic signs and pavement marking shall include road side signs, overhead signs, kerb mounted signs, cautionary and mandatory signs and road margin along the project roads. The edge line pavement marking in case of asphalt road is proposed as per the IRC Standards.

3.3 Structural design

3.3.1 Methodology

- All cross drainage structures are designed based on the IRC guide lines.
- All the new cross drainage structures if any are designed for the available road way width as shown in typical cross sections.
- The hydrological study of the area comprising side drains sand culverts.

3.3.2 Loadings

The code of practice for the loading standards as per IRC: 6-2000- Loads and Stresses is followed.

3.3.3 Concrete:

Grade of concrete for various components shall be as per the design requirements and will be indicated on the relevant drawings. Type of cement shall be OPC for all components of works.

3.3.4 Reinforcement:

HYSD bars of grade Fe415/Fe500 shall be used.

3.3.5 Side drains

In order to ensure that there is a proper disposal of runoff from the road influential area, there is a necessity of good drainage network including cross drainage structures at suitable locations. The required cross section along with proper slope to discharge the run off effectively is checked and ensured. The damaged side walls of drain in Size Stone Masonry and also in concrete are proposed for repairs and rehabilitation. The damaged cover slabs are also proposed to replace with new Precast/RCC slabs.

3.3.6 Culverts

The existing vent way of culverts has been verified and ensured to collect and discharge the rain water effectively. The damaged head walls, parapets, coping and deck slabs are proposed for Repair/Reconstruction.

DESIGN DETAILS OF FLEXIBLE PAVEMENT AS PER IRC 37-2012

The crust thickness based on 2 msa for CBR 6-7% is as follows:

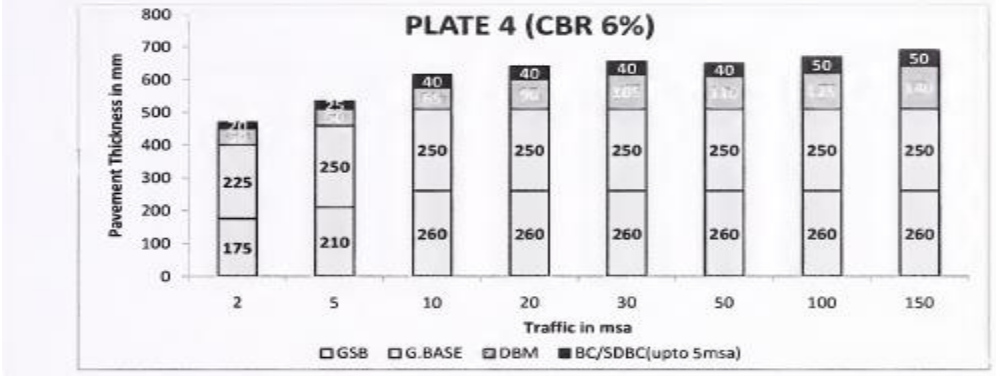
Note: IRC:37-2012

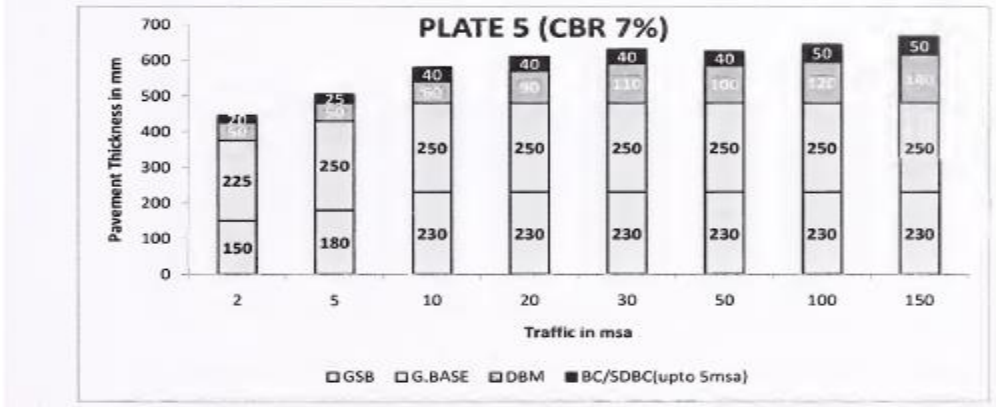
(a) These charts are to be used for traffic of 2 msa and above. For traffic below 2 msa IRC SP 72-2007 should be referred to. City roads should be designed for minimum 2 msa traffic.

(b) Thickness design for traffic between 2 and 30 msa is exactly as per IRC 37-2001.

(c) In all cases of cementitious sub-bases (i.e. cases 2,3 and 4 above) the top 100 mm thickness of sub-base is to be porous and act as drainage layer

IRC:37-2012





Proposed Crust Thickness of Flexible Pavement:

BC=40 mm

BM=50mm

WMM=230mm

GSB layer=150mm

Note: A proposed crust thickness is providing based on guidelines by BBMP, site condition.

Chapter 4
Analysis, Design and Improvements

4.1 General

Improvement proposals for an existing road section essentially consist of two components, geometric and structural improvements. Geometric improvement deals with visible dimensions of roadway, probable road widening and is dictated by the traffic and economic considerations. Due to the inherent restrictions like limitation in land acquisition, limited right of way and existing utility and service, etc. The horizontal and vertical alignments in general follow the existing geometry except in situations where improvements to cross sectional elements such as carriageway, shoulders, etc. The structural component deals with the pavement and embankment design aspects, i.e., the ability of the road to adequately carry and support the vehicle / wheel loads over the design period. Safety, speed, efficiency, economy and comfort in traffic movement to a large extent are governed by adequacy of design standards used for a specific road facility.

The improvements proposals need to consider the method of widening like concentric or eccentric to the existing road which is dictated by site situations like available land for acquisition, curvature, existing utilities, terrain, places of worship, monuments, grave yards, places of importance etc.

This chapter deals with the analysis of data collected during various engineering surveys/investigations and the formulation of improvement proposals including planning and design.

4.2 Road inventory and Physical Characteristics of Road Sections

Investigation ad studies have been carried out along the project stretch. Physical Consultancy Services for preparation of Survey, Designs, Drawing, Estimate preparation etc.,(Detailed Project Report) For the work of

Construction of Asphalt roads at chowdappa layout , Maruthi Layout, Hillside Medows and surrounding areas in ward no -03 Yelahanka Satellite Town sub Division.

List of Drains and Culverts Considered for Construction:

- Chowdappa Layout.
- Doddabettahalli Main Road
- BT Nagaraj Layout
- Maruthi Nagar
- Hariraja Badavane
- Hillside Meadows Layout

Chapter 5

Cost Estimates

5.1 Project Cost

The cost estimates has been prepared for the work of Construction of Asphalt roads at chowdappa layout , Maruthi Layout, Hillside Medows and surrounding areas in ward no -03, amounting to **Rs. 200.00 lakhs.** Estimates are prepared duly making provision for various items as per the discussions and directions issued by Executive Engineer, BBMP, Yelahanka Satellite Town sub Division, along with concerned Assistant Executive Engineers of BBMP.

5.2 Basic rates

Unit rates are adopted for the items of all project based on the schedule of rates of PWD, Bangalore circle, Bangalore for the year 2018-19 continued for 2019-20 also. An area weight age mentioned in schedule of rates is also considered above the basic rates. Actual rate analysis will have to be worked out considering prevailing market rates for Bitumen, Cement and Steel at the time of Tender Evaluation.

5.3 DPR Preparation, Project Management and Quality control

Provision of 0.5% of construction cost has been made towards DPR preparation and 0.5% for PMC charges and third party inspection

5.4 Lump sum provision:-

The Lump sum provision in every estimate has been made towards the restoration / repairs of likely damages caused to W.S & sanitation pipe lines & C.G chambers during Execution.

5.5 Quantification of items

The Quantification of most of the items that are uniformly occurring is calculated per meter based on the cross sections. In the respect of culverts and longitudinal drains, provision has been made in the estimate to rectify the damaged portions. The traffic safety measures are also incorporated in the project estimate.

5.6 Project Cost

The estimated cost for construction of Asphalt to roads has been worked out **for Rs. 200.00 lakhs** based on the CSR of PWD, Bangalore circle, Bangalore for the year 2018-19 continued for 2019-2020.

Investigation ad studies have been carried out along the project stretch. Physical Consultancy Services for preparation of Survey, Designs, Drawing, Estimate preparation etc., (Detailed Project Report) for the work of

a) Construction of Asphalt roads at chowdappa layout , Maruthi Layout, Hillside Medows and surrounding areas in ward no -03 Yelahanka Satellite Town sub Division.

Chapter 6

Conclusion

6.1 Summary and Recommendations

a) Overlay of existing roads with Tack coat, bituminous concrete 40mm and marking with laying of hot applied thermoplastic compound paint.
b) Filling Pot holes, pipe line and UGD cuttings by Earth work excavation of 230mm, Wet mix macadam 230mm thickness, primer coat and finished by overlay.
c) Removing and resetting footpath for de-silting of the drains.

Annexure-1

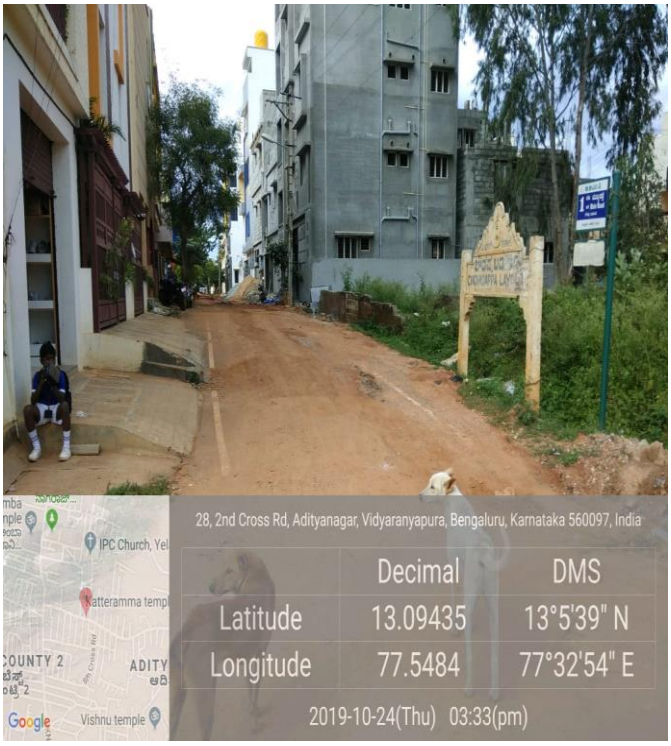
Estimation

"Consultancy services for preparation of DPR for the work of Asphalting to roads at chowdappa layout , Maruthi Layout, Hillside Medows and surrounding areas in ward no -03 Yelahanka Satellite Town sub Division"

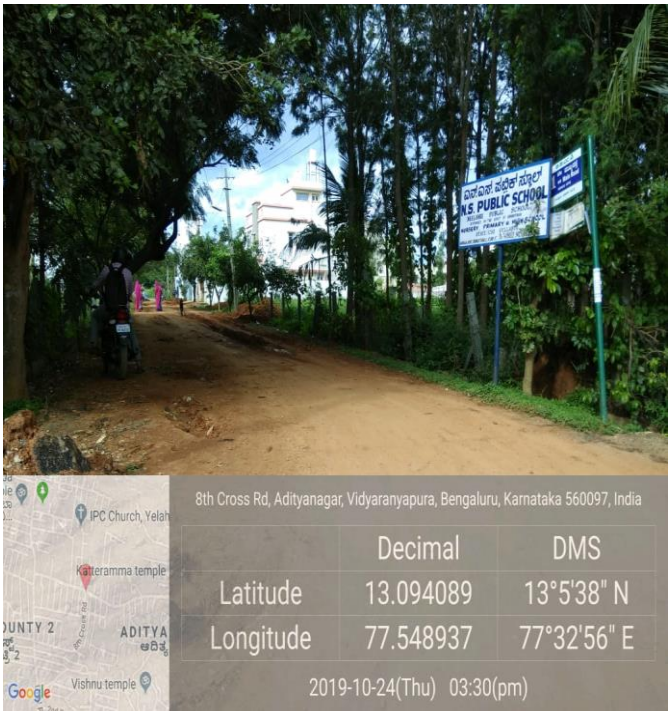
Annexure-2

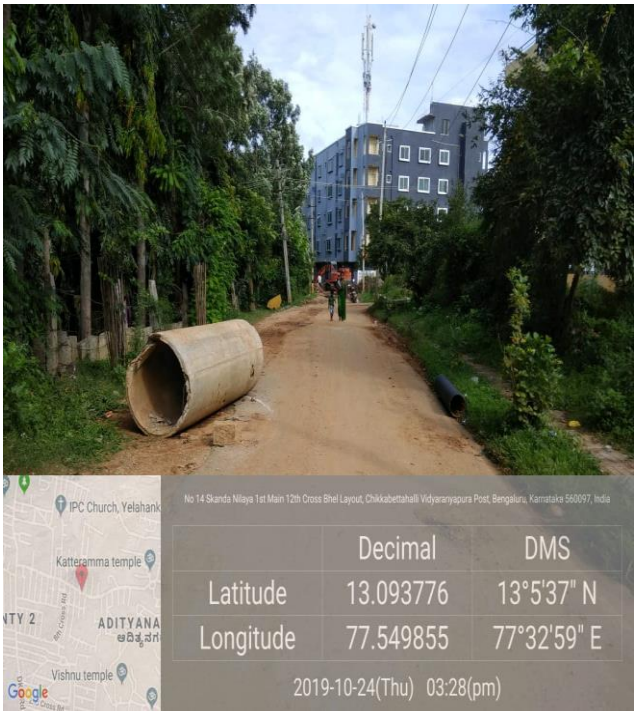
Photographs

Name of work: "Consultancy services for preparation of DPR for the work of **Asphalting to roads** at chowdappa layout , Maruthi Layout, Hillside Medows and surrounding areas in ward no -03 Yelahanka Satellite Town sub Division" Est cost Rs. 200 Lakhs"

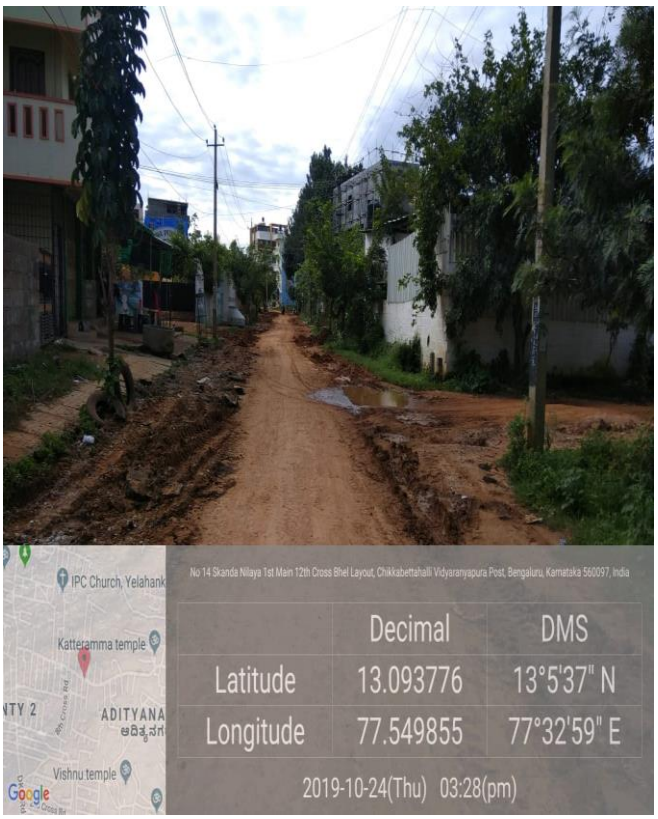

28, 2nd Cross Rd, Adityanagar, Vidyaranyapura, Bengaluru, Karnataka 560097, India
Decimal DMS
Latitude 13.09435 13°5'39" N
Longitude 77.5484 77°32'54" E
2019-10-24(Thu) 03:33(pm)

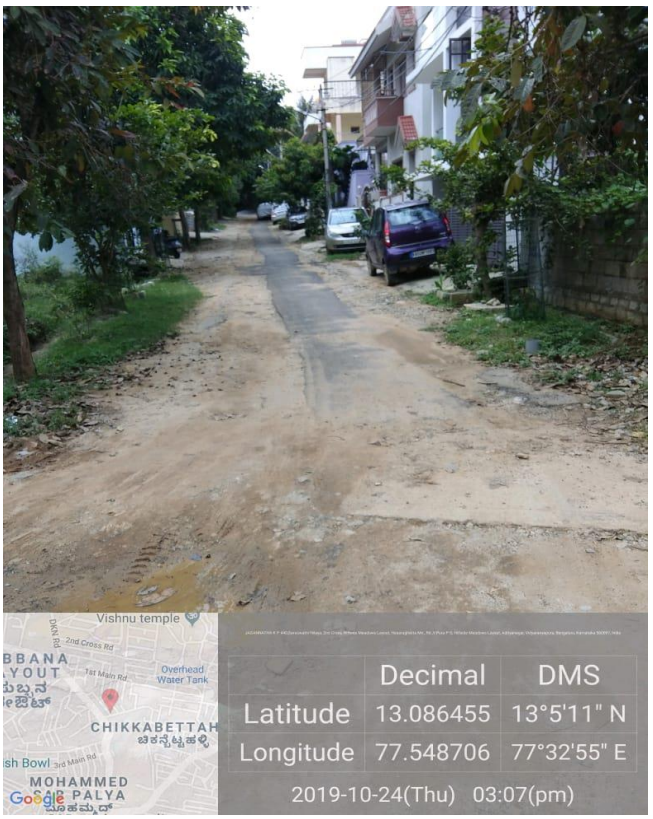
8th Cross Rd, Adityanagar, Vidyaranyapura, Bengaluru, Karnataka 560097, India
Decimal DMS
Latitude 13.094333 13°5'39" N
Longitude 77.548965 77°32'56" E
2019-10-24(Thu) 03:33(pm)

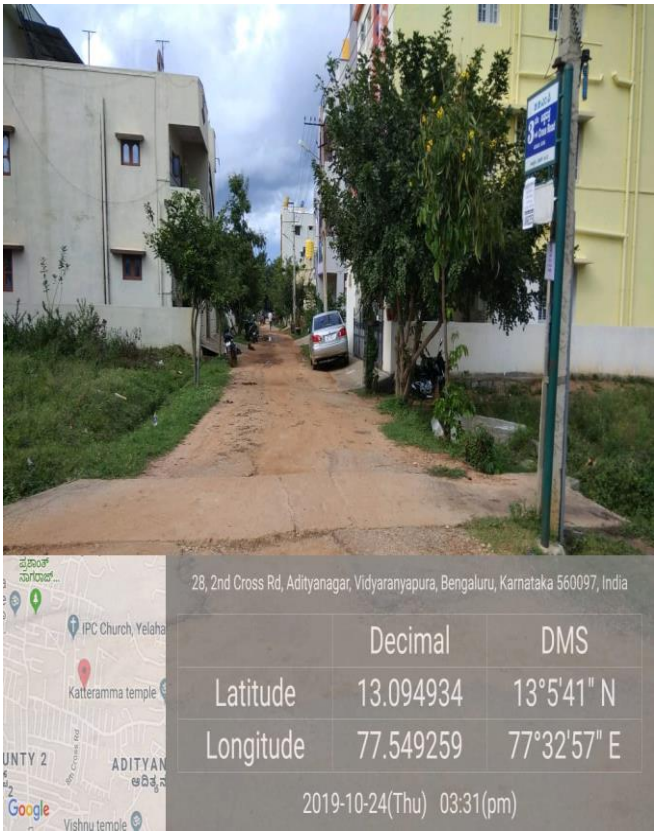

N.S. PUBLIC SCHOOL
8th Cross Rd, Adityanagar, Vidyaranyapura, Bengaluru, Karnataka 560097, India
Decimal DMS
Latitude 13.094089 13°5'38" N
Longitude 77.548937 77°32'56" E
2019-10-24(Thu) 03:30(pm)



“Consultancy services for preparation of DPR for the work of Asphalting to roads at chowdappa layout , Maruthi Layout, Hillside Medows and surrounding areas in ward no -03 Yelahanka Satellite Town sub Division”


No 14 Skanda Nilaya 1st Main 12th Cross Bhel Layout, Chikkabettahalli Vidyaranyapura Post, Bengaluru, Karnataka 560097, India
Decimal DMS
Latitude 13.093776 13°5'37" N
Longitude 77.549855 77°32'59" E
2019-10-24(Thu) 03:28(pm)




28, 2nd Cross Rd, Adityanagar, Vidyaranyapura, Bengaluru, Karnataka 560097, India
Decimal DMS
Latitude 13.094934 13°5'41" N
Longitude 77.549259 77°32'57" E
2019-10-24(Thu) 03:31(pm)

28, 2nd Cross Rd, Adityanagar, Vidyaranyapura, Bengaluru, Karnataka 560097, India
Decimal DMS
Latitude 13.094995 13°5'41" N
Longitude 77.549104 77°32'56" E
2019-10-24(Thu) 03:31(pm)

BRUHAT BANGALORE MAHANAGARA PALIKE

YELAHANKA ZONE

Name of work:"Consultancy services for preparation of DPR for the work of Asphalting to roads at chowdappa layout , Maruthi Layout, Hillside Medows and surrounding areas in ward no -03 Yelahanka Satellite Town sub Division" Est cost Rs. 200 Lakhs"

		Estimate Cost Rs.							20000000
Sl No	**Description of item**	**Unit**	**No**	**L**	**B**	**D**	**Qty**	**Rate**	**Amount**
1	KSRRB 300-1. **Earth work excavation** by manual means in Ordinary Soil soil involving an average horizontal throw upto 2 meters and an average lift upto 0.5m, excavated surface leveled and sides neatly dressed, the disposed earth to be leveled neatly after breaking of clods complete as per specifications complete as per specifications.MORTH chapter 3. P No. 143/ Item No. 19.1/ PWD SR 2018-19								
		Cum							
	RCC Drain								
	BHEL Layout								
	BHEL 3rd Cross road LHS		1	118	1.1	1.0	129.80		
	BHEL 4th Cross road LHS		1	115	1.1	1.0	126.50		
	BHEL 4th Cross road RHS		1	115	1.1	1.0	126.50		
	BHEL 5th Cross road LHS		1	110	1.1	1.0	121.00		
	BHEL 5th Cross road RHS		1	110	1.1	1.0	121.00		
						Cum	**624.80**	**211.79**	**132326.00**
	Basic Rate	**130.00**							
	Lead and Lift	**73.99**							
	Area Weightage @ 6%	**7.80**							
	Total	**211.79**							
2	KSRRBM29001.Plain cement concrete M10 mix with crushed stone aggregate 40mm nominal size mechanically mixed,placed infoundation and compacted by vibration including curing including cost of materials,labour, HOM complete as per the specification Specification No. P No. 254/ Item No. 34.2/ PWD SR 2018-19								
		cum							
	RCC Drain								
	BHEL Layout								
	BHEL 3rd Cross road LHS		1	118	1.1	0.15	19.47		
	BHEL 4th Cross road LHS		1	115	1.1	0.15	18.98		
	BHEL 4th Cross road RHS		1	115	1.1	0.15	18.98		
	BHEL 5th Cross road LHS		1	110	1.1	0.15	18.15		
	BHEL 5th Cross road RHS		1	110	1.1	0.15	18.15		
						cum	**93.72**	**4479.56**	**419824**
	Basic Rate	**4226**							
	Area Weightage @ 6%	**253.56**							
	Total	**4479.56**							
3	Providing and laying plain/reinforced cement concrete for side drains using M20 nominal mix concrete with OPC at 300 kgs. with 20mm and down size granite metal coarse aggregates at 0.69 cum and fine aggregates at 0.43 cum machine mixed, well compacted for walls and bottom including centering, shuttering, cost of materials, HOM of machinery, curing etc., complete excluding cost of steel as per MORTH specification No. 1500, 1700, 2200. including cost of materials, labour, HOM complete as per specifications.. Item No. 37.59.2/ page no:271/PWD SR 2018-19								
	RCC Drain Raft	Cum							
	BHEL Layout								
	BHEL 3rd Cross road LHS		1	118	0.9	0.15	15.93		
	BHEL 4th Cross road LHS		1	115	0.9	0.15	15.53		
	BHEL 4th Cross road RHS		1	115	0.9	0.15	15.53		
	BHEL 5th Cross road LHS		1	110	0.9	0.15	14.85		
	BHEL 5th Cross road RHS		1	110	0.9	0.15	14.85		
	RCC Drain wall								
	BHEL Layout								
	BHEL 3rd Cross road LHS		2	118	0.15	0.7	24.78		
	BHEL 4th Cross road LHS		2	115	0.15	0.7	24.15		
	BHEL 4th Cross road RHS		2	115	0.15	0.7	24.15		
	BHEL 5th Cross road LHS		2	110	0.15	0.7	23.10		
	BHEL 5th Cross road RHS		2	110	0.15	0.7	23.10		
						Cum	**195.96**	**7070.2**	**1385476**
	Basic Rate	**6670**							
	Area Weightage @ 6%	**400.2**							
	Total	**7070.2**							

4	KSRB 4.9.2 : Providing **T.M.T steel reinforcement for R.C.C work** including straightening, cutting, bending, hooking, placing in position, lapping and / or welding wherever required, tying with binding wire and anchoring to the adjoining members wherever necessary complete as per design (laps, hooks and wastage shall not be measured and paid) cost of materials, labour, HOM complete as per specifications. Specificatio (I No-28.8.2,P No-229)								
		Tonne							
	All Culverts and Drains included								
	60kg/Cum for Culvert		60	195.96			11074		
						Tonne	**11.07**	**72326.98**	**800949**
	Basic Rate	**68233**							
	Area Weightage @ 6%	**4093.98**							
	Total	**72327**							
5	Providing and Fixing **pre cast covering Slab** made out of CC 1:2:4 with 10cm thick and Finishing cutting ,including form work,curing,including cost of alll materials, labour,hire charges of machinery,loading,unloading,lead and lift,transportation etc ,copmplete. (Data Rate)								
		Sqm							
	RCC Drain								
	BHEL 3rd Cross road LHS		1	118	0.9		106.20		
	BHEL 4th Cross road LHS		1	110	0.9		99.00		
	BHEL 4th Cross road RHS		1	115	0.9		103.50		
	BHEL 5th Cross road LHS		1	110	0.9		99.00		
	BHEL 5th Cross road RHS		1	110	0.9		99.00		
						Sqm	**506.70**	**2337**	**1184158**
	Data Rate	**2337**							
6	5.29(b) Providing and fixing **pre cast solid cement concrete kerb stones** made out of C.C 1:2:4 with top and bottom width 114 and 165mm repectively, 400mm high and 450mm in length finished with CM 1:3 plastering and finishing cutting, including formwork curing, including, cost of all materials, labour hire charges of machinery, loading unloading, lead and lift, transportation etc, complete. Page No. 27/ Item No. 5.30/ PWD SR 2018-19								
		Nos							
	RCC Drain								
	BHEL 3rd Cross road LHS		1	118			118.00		
	BHEL 4th Cross road LHS		1	115			115.00		
	BHEL 4th Cross road RHS		1	115			115.00		
	BHEL 5th Cross road LHS		1	110			110.00		
	BHEL 5th Cross road RHS		1	110			110.00		
							567.90		
				I.e 1795/0.45			1262.00		
						Nos	**1262**	**477**	**601974.00**
	Basic Rate	**450**							
	Area Weightage @ 6%	**27**							
	Total	**477**							
7	KSRRB 800-1. Painting two coats after filling the surface with synthetic enamel paint in approved shades on new plastered concrete surfaces, with materials, labour complete as per specifications. MORTH Chapter 8 (P.No.180, I.No.24.1 of PW, P&IWTD SR 2018-19)								
		Sqm							
	RCC Drain								
	BHEL 3rd Cross road LHS		1	118		0.4	47.20		
	BHEL 4th Cross road LHS		1	115		0.4	46.00		
	BHEL 4th Cross road RHS		1	115		0.4	46.00		
	BHEL 5th Cross road LHS		1	110		0.4	44.00		
	BHEL 5th Cross road RHS		1	110		0.4	44.00		
						Sqm	**227.20**	**84.8**	**19267**
	Basic Rate	**80**							
	Area Weightage @ 6%	**4.8**							
	Total	**84.8**							
8	KSRRB M300-13. Excavation for roadway in hard rock (requiring blasting) by drilling, blasting and breaking, trimming of bottom and side slopes in accordance with requirements of lines, grades and cross sections, loading and stacking at site of cut road with a lead of 1.00 km and complete as per specifications. (Excavated rock credited to contractor) MORTH Specification No. 301								
		Cum							
	line)								
	Maruthi Nagar								
	Maruthi Nagar 1st Main Road		2	240	1	0.3	144.00		
	Maruthi Nagar 4th cross road		2	135	1	0.3	81.00		
	Drain Desilt								
	Chowdappa Layout 1st main road		2	200	0.5	0.35	70.64		
	Maruthi Nagar								
	Maruthi Nagar 1st Main Road		2	240	0.6	0.45	129.60		
	Maruthi Nagar 2nd cross road		2	52	0.6	0.45	28.08		

	Maruthi Nagar 3rd cross road		2	175	0.6	0.45	94.50		
	Maruthi Nagar 4th cross road		2	135	0.6	0.45	72.90		
	Hariraja Badavane								
	Hariraja Badavane Cross-2nd		2	65	0.6	0.45	35.10		
	Hariraja Badavane Cross-3rd		2	77	0.6	0.45	41.58		
	Hariraja Badavane Cross-4th		2	82	0.6	0.45	44.28		
	Hariraja Badavane Cross-5th		2	108	0.6	0.45	58.32		
	New Road								
	Maruthi Nagar 2nd cross road		1	52	4.5	0.3	70.20		
	Hariraja Badavane								
	Hariraja Badavane Cross-2nd		1	65	5	0.3	97.50		
	Hariraja Badavane Cross-3rd		1	77	5	0.3	115.50		
	Hariraja Badavane Cross-4th		1	82	5	0.3	123.00		
	Hariraja Badavane Cross-5th		1	108	5	0.3	162.00		
	BHEL Layout								
	BHEL 1st Cross road LHS		1	125	6	0.3	225.60		
	BHEL 2nd Cross road LHS		1	125	6	0.3	225.00		
	Profile correction and Restoration of Cutting (20% of the total length of road)		1	391	4	0.3	469.60		
						Cum	**2288.40**	**43.46**	**99454**
	Basic Rate	**41**							
	Area Weightage @ 6%	**2.46**							
	Total	**43.46**							
9	KSRRB 300-50. Scarifying bituminous course 50mm to 75mm thick along with premix carpet / surface dressing by road roller attached with scarifier without disturbing the base and stacking the debris including cost of all labour charges, HOM of machineries complete as per specifications. MORTH / Chapter 3(P.No.146, I.No.19.56)								
		Sqm							
	Reconstruction								
	BHEL 3rd Cross road LHS		1	118	6		708.00		
	BHEL 4th Cross road LHS		1	115	6		690.00		
	BHEL 5th Cross road LHS		1	110	6		660.00		
	Chowdappa Layout 1st main road		1	200	5		1002.00		
	Maruthi Nagar 3rd cross road		1	175	5		875.00		
						Sqm	**3935.00**	**41.34**	**162673**
	Basic Rate	**39**							
	Area Weightage @ 6%	**2.34**							
	Total	**41.34**							
10	KSRRB 300-58. Compaction of original ground by mechanical means including filling in depression occuring during rolling including cost of all labour, HOM complete as per specifications.(I No-19.64,P No-147)								
		Sqm							
	Hariraja Badavane								
	Hariraja Badavane Cross-2nd		1	65	5		325.00		
	Hariraja Badavane Cross-3rd		1	77	5		385.00		
	Hariraja Badavane Cross-4th		1	82	5		410.00		
	Hariraja Badavane Cross-5th		1	108	5		540.00		
	Maruthi Nagar								
	Maruthi Nagar 2nd cross road		1	52	4.5		234.00		
	Maruthi Nagar 3rd cross road		1	175	5		875.00		
	Reconstruction								
	BHEL 1st Cross road LHS		1	125	6		752.00		
	BHEL 2nd Cross road LHS		1	125	6		750.00		
	BHEL 3rd Cross road LHS		1	118	6		708.00		
	BHEL 4th Cross road LHS		1	115	6		690.00		
	BHEL 5th Cross road LHS		1	110	6		660.00		
	Chowdappa Layout 1st main road		1	200	5		1002.00		
						Sqm	**7331.00**	**6.36**	**46625**
	Basic Rate	**6**							
	Area Weightage @ 6%	**0.36**							
	Total	**6.36**							
11	Construction of granular sub-base Grading-V as Sub-base and drainage layer by providing coarse graded crushed stone aggregates of granite/ trap/basalt material, mixing in a mechanical mix plant at OMC, Carriage of mixed material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the 98 % proctor density, complete as per specifications Clause 401 of MORTH V Revision.(I No-20.6,P No-153)								
		Cum							
	New Roads								

	Maruthi Nagar 2nd cross road		1	52	4.5	0.15	35.10		
	Hariraja Badavane								
	Hariraja Badavane Cross-2nd		1	65	5	0.15	48.75		
	Hariraja Badavane Cross-3rd		1	77	5	0.15	57.75		
	Hariraja Badavane Cross-4th		1	82	5	0.15	61.50		
	Hariraja Badavane Cross-5th		1	108	5	0.15	81.00		
	BHEL Layout								
	BHEL 1st Cross road LHS		1	125	6	0.15	112.80		
	BHEL 2nd Cross road LHS		1	125	6	0.15	112.50		
	Profile correction and Restoration of Cutting		1	391	1	0.3	105.90		
						Cum	**615.30**	**1855**	**1141387**
	Basic Rate	**1750**							
	Area Weightage @ 6%	**105**							
	Total	**1855**							
12	KSRRB M400-17. Providing, laying, spreading and compacting cushed stone aggregates of granite / trap / basalt to **wet mix macadam** specifications including pre mixing the material with water at OMC in mechanical mix plant carriage of mixed materials by tipper to site, laying in uniform layers with paver in sub-base/base course on well prepared surface and compacting with vibratory roller to achieve the desired density complete as per specifications(P.No-155,I No-20.18)								
		Cum							
	Road cutting portion								
	Maruthi Nagar								
	Maruthi Nagar 1st Main Road entry		2	240	1	0.23	110.40		
	Maruthi Nagar 4th cross road		2	135	1	0.23	62.10		
	New Roads								
	Hariraja Badavane								
	Hariraja Badavane Cross-2nd		1	65	5	0.23	74.75		
	Hariraja Badavane Cross-3rd		1	77	5	0.23	88.55		
	Hariraja Badavane Cross-4th		1	82	5	0.23	94.30		
	Hariraja Badavane Cross-5th		1	108	5	0.23	124.20		
	Maruthi Nagar								
	Maruthi Nagar 2nd cross road		1	52	4.5	0.23	53.82		
	Maruthi Nagar 3rd cross road		1	175	5	0.23	201.25		
	Reconstruction								
	BHEL 1st Cross road LHS		1	125	6	0.23	172.96		
	BHEL 2nd Cross road LHS		1	125	6	0.23	172.50		
	BHEL 3rd Cross road LHS		1	118	6	0.23	162.84		
	BHEL 4th Cross road LHS		1	115	6	0.23	158.70		
	BHEL 5th Cross road LHS		1	110	6	0.23	151.80		
	Chowdappa Layout 1st main road		1	200	5	0.23	230.46		
	Profile correction and Restoration of Cutting (20% of the total length of road)		1	391	5	0.23	437.40		
						Cum	**2296.03**	**2001.28**	**4594999**
	Basic Rate	**1888**							
	Area Weightage @ 6%	**113.28**							
	Total	**2001.28**							
13	KSRRB M500-6. Providing and applying **primer coat** with S.S. bitumen emulsion on prepared surface of granular base such as WMM including cleaning of road surface and spraying primer at the rate of 0.60 kg / sqm using mechanical means complete as per specifications Clause 502 of MORTH V revision(P.No-158,I No-21.6)								
		Sqm							
	Road cutting portion								
	Maruthi Nagar								
	Maruthi Nagar 1st Main Road entry		2	240	1		480.00		
	Reconstruction								
	BHEL 1st Cross road LHS		1	125	6		752.00		
	BHEL 2nd Cross road LHS		1	125	6		750.00		
	BHEL 3rd Cross road LHS		1	118	6		708.00		
	BHEL 4th Cross road LHS		1	115	6		690.00		
	BHEL 5th Cross road LHS		1	110	6		660.00		
	Chowdappa Layout 1st main road		1	200	5		1002.00		
	Profile correction and Restoration of Cutting		1	391	0.5		207.99		
						Sqm	**5250.00**	**33.92**	**178080**
	Basic Rate	**32**							
	Area Weightage @ 6%	**1.92**							
	Total	**33.92**							

14	KSRRB 500-11. Providing and laying **bituminous macadam** on Prepared Surface with crushed Coarse aggregates as per Design mix formulae for base/binding course including loading of aggregates with F.E loader,Hot mixing of Stone aggregates and bitumen in Hot mix plant, transporting the mixed material in tipper to paver and laying mixed materials with paver finisher to the required level and grade, rolling by power roller to achieve desired density, but excluding cost of primer/Tack coat including lead, lift and cost of all materials, labour HOM of machinaries complete as per Specifications. MORTH Ch 5. using 40/60 TPH capacity HMP with Mechanical paver Gr-II (50mm - 75mm) with 3.4% VG-30 bitumen.(P.No-159,I No-21.11.6)								
			Cum						
	Road cutting portion								
	Maruthi Nagar								
	Maruthi Nagar 1st Main Road entry		2	240	1	0.05	24.00		
	Reconstruction								
	BHEL 1st Cross road LHS		1	125	6	0.05	37.60		
	BHEL 2nd Cross road LHS		1	125	6	0.05	37.50		
	BHEL 3rd Cross road LHS		1	118	6	0.05	35.40		
	BHEL 4th Cross road LHS		1	115	6	0.05	34.50		
	BHEL 5th Cross road LHS		1	110	6	0.05	33.00		
	Chowdappa Layout 1st main road		1	200	5	0.05	50.10		
	Profile correction and Restoration of Cutting		1	391	0.5	0.05	10.40		
						Cum	**262.50**	**7428.48**	**1949975**
	Basic Rate	**7008**							
	Area Weightage @ 6%	**420.48**							
	Total	**7428.48**							
15	KSRRB M500-2: **Cleaning the excisting** black topped surface with brooms, soft brushs and finally dusting with old gunny bags and compressed air to receive bituuminous tratement including cost of all materials, labours, HOM complete as per specifications. P No. 158/ Item No. 21.2/ PWD SR 2018-19								
			Sqm						
	Maruthi Nagar								
	Maruthi Nagar 1st Main Road entry		1	240	6		1440.00		
	Maruthi Nagar 4th cross road		1	135	5		675.00		
						Sqm	**2115.00**	**5.3**	**11210**
	Basic Rate	**5**							
	Area Weightage @ 6%	**0.3**							
	Total	**5.3**							
16	KSRRB M500-10. Tack Coat:- Providing and applying **tack coat** using 80/100 grade bitumen (VG 10) in boiler fitted with spray set distributor at the rate of 0.20 kg per sqm on the existing prepared bituminous surface cleaned with mechancial broom. complete as per specifications. MORTH Specification No. 503 (P-159, Item.no 21.10).								
			Sqm						
	Road cutting portion								
	Maruthi Nagar								
	Maruthi Nagar 1st Main Road entry		1	240	6		1440.00		
	Maruthi Nagar 2nd cross road		1	52	4.5		234.00		
	Maruthi Nagar 3rd cross road		1	175	5		875.00		
	Maruthi Nagar 4th cross road		1	135	5		675.00		
	New Roads								
	Hariraja Badavane								
	Hariraja Badavane Cross-2nd		1	65	5		325.00		
	Hariraja Badavane Cross-3rd		1	77	5		385.00		
	Hariraja Badavane Cross-4th		1	82	5		410.00		
	Hariraja Badavane Cross-5th		1	108	5		540.00		
	Reconstruction								
	BHEL 1st Cross road LHS		1	125	6		752.00		
	BHEL 2nd Cross road LHS		1	125	6		750.00		
	BHEL 3rd Cross road LHS		1	118	6		708.00		
	BHEL 4th Cross road LHS		1	115	6		690.00		
	BHEL 5th Cross road LHS		1	110	6		660.00		
	Chowdappa Layout 1st main road		1	200	5		1002.00		
	Profile correction and Restoration of Cutting (20% of the total length of road)		1	391	4		1458.00		
						Sqm	**10904.00**	**12.72**	**138699**
	Basic Rate	**12**							
	Area Weightage @ 6%	**0.72**							
	Total	**12.72**							

17	KSRRB M500-19: providing and laying **bituminous concrete** 40mm thick with 100-120 TPH batch type hot mix plant producing an average output of 75 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder at 5.4 to 5.6% of mix and filler, transporting the hot mix to work site, laying with hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem roller to achieve the desire compaction as per MORTH specification clause No. 500.9 complete In all respects as per specifications. MORTH specification 30-45mm compacted thicikness (GradingII) With 6% bitumen 80/100, No. 161/ Item No. 21.22.6/ PWD SR 2018-19								
				Cum					
	Road cutting portion								
	Maruthi Nagar								
	Maruthi Nagar 1st Main Road entry		1	240	6	0.04	57.60		
	Maruthi Nagar 2nd cross road		1	52	4.5	0.04	9.36		
	Maruthi Nagar 3rd cross road		1	175	5	0.04	35.00		
	Maruthi Nagar 4th cross road		1	135	5	0.04	27.00		
	New Roads								
	Hariraja Badavane								
	Hariraja Badavane Cross-2nd		1	65	5	0.04	13.00		
	Hariraja Badavane Cross-3rd		1	77	5	0.04	15.40		
	Hariraja Badavane Cross-4th		1	82	5	0.04	16.40		
	Hariraja Badavane Cross-5th		1	108	5	0.04	21.60		
	Reconstruction								
	BHEL 1st Cross road LHS		1	125	6	0.04	30.08		
	BHEL 2nd Cross road LHS		1	125	6	0.04	30.00		
	BHEL 3rd Cross road LHS		1	118	6	0.04	28.32		
	BHEL 4th Cross road LHS		1	115	6	0.04	27.60		
	BHEL 5th Cross road LHS		1	110	6	0.04	26.40		
	Chowdappa Layout 1st main road		1	200	5	0.04	40.08		
	Profile correction and Restoration of Cutting (20% of the total length of road)		1	391	4	0.04	57.84		
						Cum	**435.68**	**8831.92**	**3847891**
	Basic Rate	**8332**							
	Area Weightage @ 6%	**499.92**							
	Total	**8831.92**							
18	KSRRB M800-13. Providing and laying of **hot applied thermoplastic** compound 2.5 mm thick including reflectorising glass beads at 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35. The finished surface to be level, uniform and free from streaks and holes complete as per specifications. MORTH Specification No. 803 (Page No 181., I.No.24.15 of KPWD S.R 2015-16).								
				Sqm					
	Maruthi Nagar								
	Maruthi Nagar 1st Main Road entry		2.5	240	0.1		60.00		
	Maruthi Nagar 2nd cross road		2	52	0.1		10.40		
	Maruthi Nagar 3rd cross road		2	175	0.1		35.00		
	Maruthi Nagar 4th cross road		2	141.85	0.1		28.37		
	New Roads								
	Hariraja Badavane								
	Hariraja Badavane Cross-2nd		2	65	0.1		13.00		
	Hariraja Badavane Cross-3rd		2	77	0.1		15.40		
	Hariraja Badavane Cross-4th		2	82	0.1		16.40		
	Hariraja Badavane Cross-5th		2	109	0.1		21.80		
	Reconstruction								
	BHEL 1st Cross road LHS		2.5	125	0.1		31.33		
	BHEL 2nd Cross road LHS		2.5	125	0.1		31.25		
	BHEL 3rd Cross road LHS		2.5	118	0.1		29.50		
	BHEL 4th Cross road LHS		2.5	115	0.1		28.75		
	BHEL 5th Cross road LHS		2.5	110	0.1		27.50		
	Chowdappa Layout 1st main road		2.5	200	0.1		50.10		
						Sqm	**398.80**	**454.74**	**181352**
	Basic Rate	**429**							
	Area Weightage @ 6%	**25.74**							
	Total	**454.74**							

Sl No	Description of item	Unit	No	L	B	D	Qty	Rate	Amount
							Grand Total		17060657
22	For 12% Applicable GST								2047279
23	For 4% KRIDL Charges								682426.28
24	For 1% DPR and PMC Charges								200000
25	Miscellaneous Charges	L/S							9637.72
									20000000

Certificate:

1. The work spot has been inspected and the work is found necessary.
2. This estimate is prepared as per PWD SR of 2018-19
3. The provisions were made in this estimate are necessary and adequate.
4. This works come under B.B.M.P. limits.

Junior/Assistant Engineer

Executive Engineer
Yelahanka Satellite Town sub Division

ಸಹಾಯಕ ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು
ಯಲಹಂಕ ಉಪಗ್ರಹ ಪಟ್ಟಣ ಉಪವಿಭಾಗ,
ಬಿ.ಬಿ.ಎಂ.ಪಿ. ಬೆಂಗಳೂರು-106

Assistant Executive Engineer
Yelahanka Satellite Town sub Division

Administrative Sanction for Rs. 200.00 lakhs
Two crore only
is accorded under head P-3749
Cm. Navanagarothana llp Village
grants Annexure-07
Regis... Subject
to con... on
No EE/YNK/G2/2019-20 dt. 7/11/2019

Executive Engineer

Technical Sanction
Accorded For RS 200 lakhs only
Head of A/C P3749
CER NO: 304 Dtd 8-11-2019

AE (YNK)

TRANSHEIGHT
PAVING FUTURE

098869 13195
080236 29195
www.transheight.com
transheight.consultant@gmail.com

TESTING OF OGL SOIL SAMPLE

Name of work :"Consultancy services for preparation of DPR for the work of Asphalting to roads at chowdappa layout , Maruthi Layout, Hillside Medows and surrounding areas in ward no -03 Yelahanka Satellite Town sub Division" Est cost Rs. 200 Lakhs"

TABLE 1.GRAIN SIZE DISTRIBUTION AND ATTERBERG LIMITS

Sample No. (Location)	Grain Size Distribution			Atterberg Limits			Soil Classification	MDD (gm/cc)	OMC (%)	CBR (%)
	Gravel Size	Sand Size	Silt & Clay size	Liquid Limit	Plastic Limit	Plasticity Index				
	(%)	(%)	(%)	(%)	(%)	(%)				
Maruthi Nagar										
Sample-1	2.10	52.45	45.45	37.15	14.50	22.65	CI	1.87	11.20	6.25
Sample-2	2.15	53.47	44.38	38.16	14.70	23.46	CI	1.91	11.70	6.29
Sample-3	2.40	52.07	45.53	36.86	14.25	22.61	CI	1.89	11.00	6.27
BHEL Layout										
Sample-1	1.89	54.32	43.79	35.66	13.25	22.41	CI	1.91	10.50	6.29
Sample-2	1.95	52.82	45.23	36.91	14.25	22.66	CI	1.92	10.00	6.30
Sample-3	2.10	51.92	45.98	39.41	15.20	24.21	CI	1.90	10.50	6.28
						Average				**6.28**

Tested By,
Transheight Consultants Laboratory

#1192,'A'Block,3rdCross, 5th Main,
Sahakarnagar,Bangalore-560092